

Prentice Hall

EARTH SCIENCE



Tarbuck ♦ Lutgens

Chapter

21

Climate

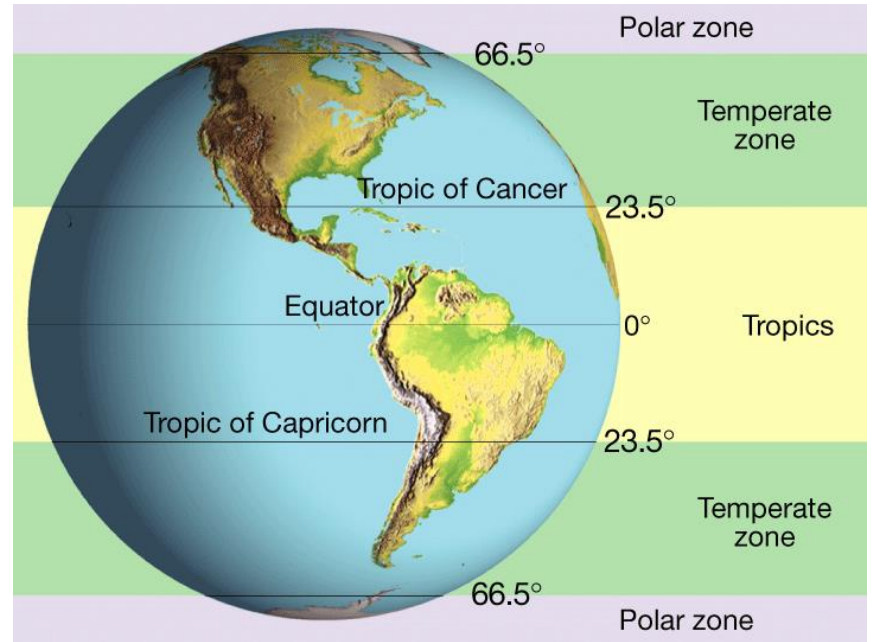
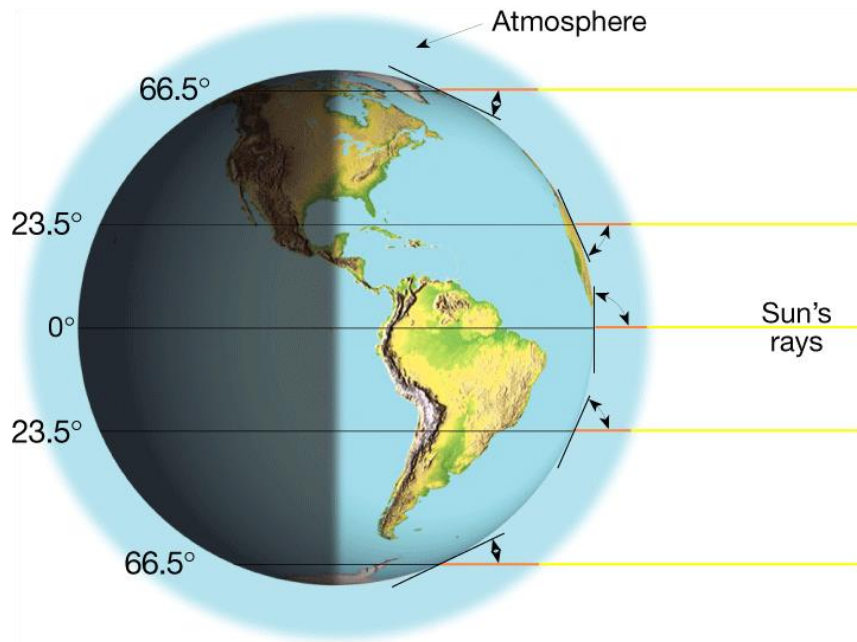
21.1 Factors That Affect Climate

Factors That Affect Climate

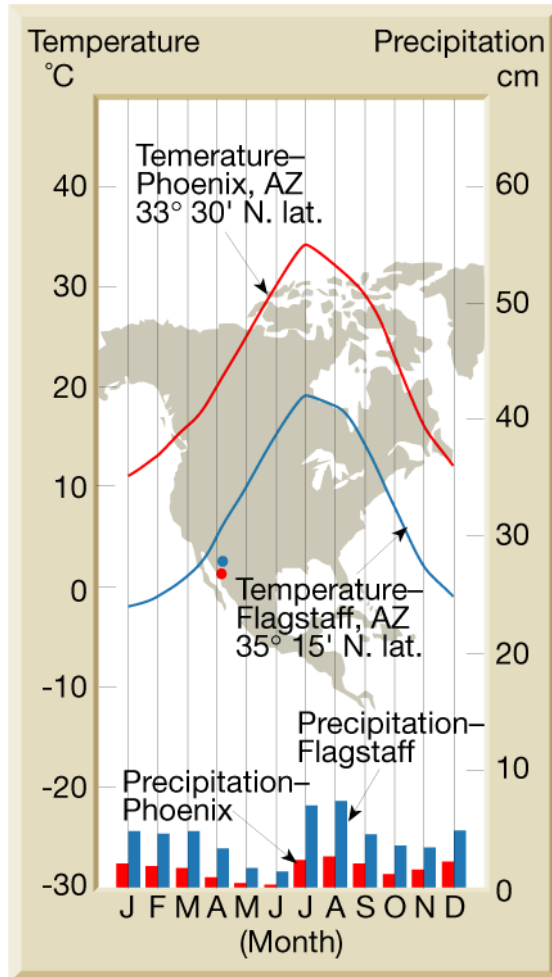
◆ Latitude

- As latitude increases, the intensity of solar energy decreases.
- The **tropical zone** is between 23.5° north (the tropic of Cancer) and 23.5° south (the tropic of Capricorn) of the equator. The sun's rays are most intense and the temperatures are always warm.
- The **temperate zones** are between 23.5° and 66.5° north and between 23.5° and 66.5° south of the equator. The sun's rays strike Earth at a smaller angle than near the equator.

Earth's Major Climate Zones



Climate Data for Two Cities



21.1 Factors That Affect Climate

Factors That Affect Climate

◆ Latitude

- **Polar zones** are between 66.5° north and south latitudes and the poles. The sun's rays strike Earth at a very small angle in the polar zones.

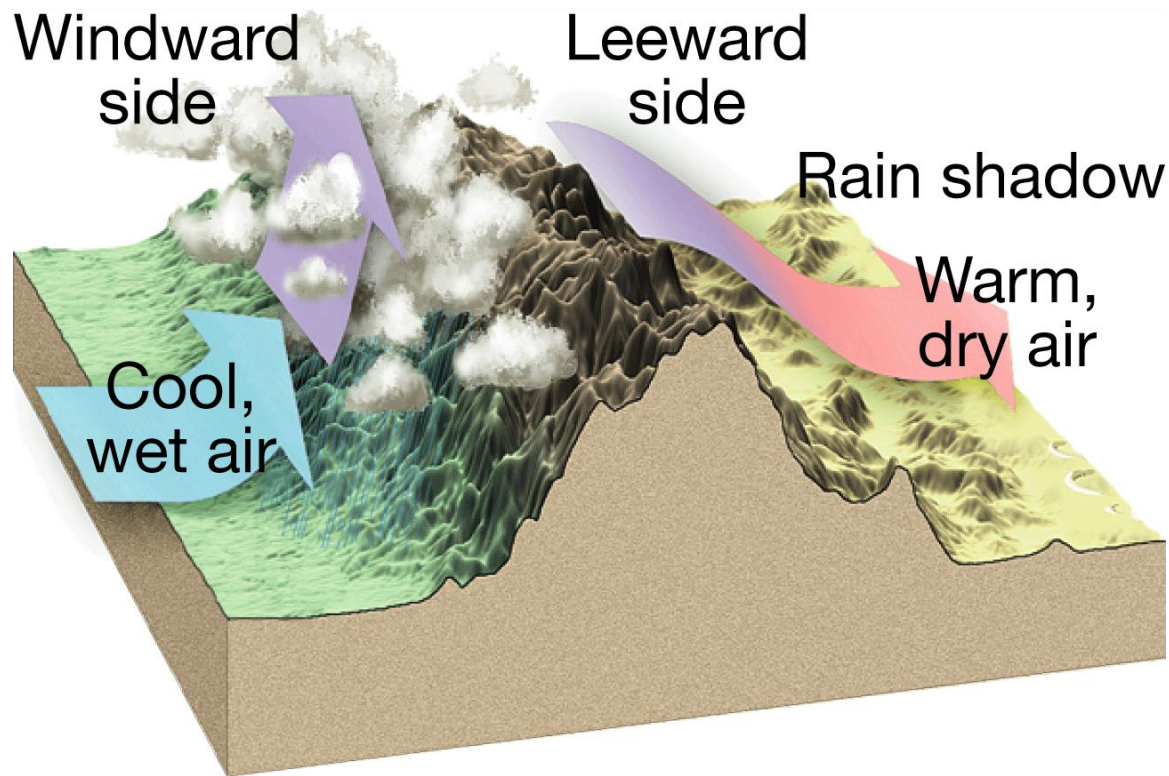
◆ Elevation

- The higher the elevation is, the colder the climate.

◆ Topography

- Topographic features such as mountains play an important role in the amount of precipitation that falls over an area.

The Rain Shadow Effect



21.1 Factors That Affect Climate

Factors That Affect Climate

◆ Water Bodies

- Large bodies of water such as lakes and oceans have an important effect on the temperature of an area because the temperature of the water body influences the temperature of the air above it.

◆ Atmospheric Circulation

- Global winds are another factor that influences climate because they distribute heat and moisture around Earth.

21.1 Factors That Affect Climate

Factors That Affect Climate

◆ Vegetation

- Vegetation can affect both temperature and the precipitation patterns in an area.

21.2 World Climates

The Köppen Climate Classification System

- ◆ The **Köppen climate classification system** uses mean monthly and annual values of temperature and precipitation to classify climates.

21.2 World Climates

Humid Tropical Climates

- ◆ Humid tropical climates are without winters. Every month in such a climate has a mean temperature above 18°C . The amount of precipitation can exceed 200 cm per year.
- ◆ Wet Tropical
 - **Wet tropical climates** have high temperatures and much annual precipitation.

Rain Forest in Malaysia



21.2 World Climates

Humid Tropical Climates

◆ Tropical Wet and Dry

- **Tropical wet and dry climates** are climates that transition between the wet tropics and the subtropical steppes.

African Savanna



21.2 World Climates

Humid Mid-Latitude Climates

- ◆ Climates with mild winters have an average temperature in the coldest month that is below 18°C but above -3°C . Climates with severe winters have an average temperature in the coldest month that is below -3°C .

21.2 World Climates

Humid Mid-Latitude Climates

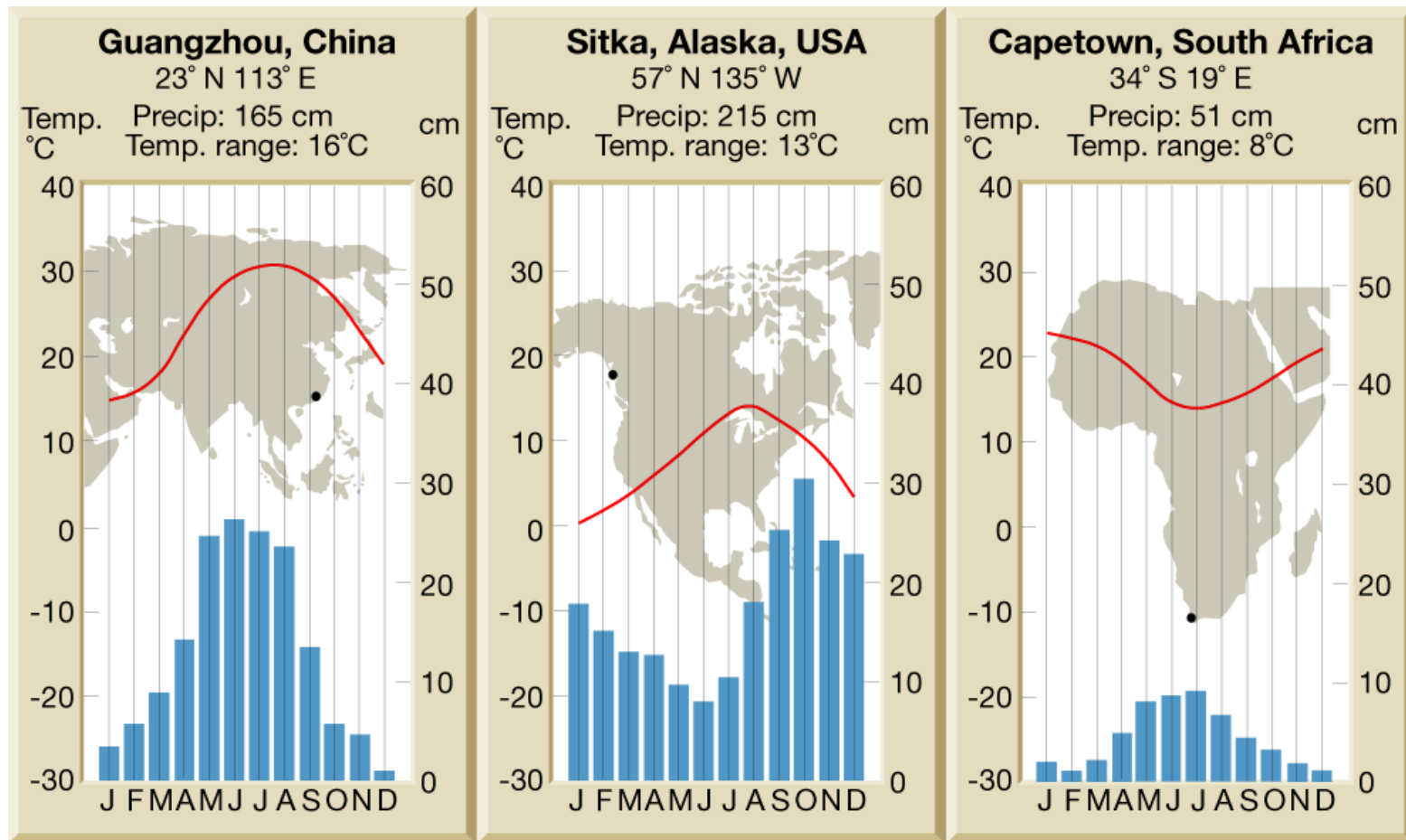
- ◆ Humid Mid-Latitude with Mild Winters
 - A **humid subtropical climate** is generally located on the eastern side of a continent and is characterized by hot, sultry summers and cool winters.
 - A **marine west coast climate** is found on windward coasts from latitudes 40° to 65° and is dominated by maritime air masses. Winters are mild, and summers are cool.

21.2 World Climates

Humid Mid-Latitude Climates

- ◆ Humid Mid-Latitude With Mild Winters
 - A **dry-summer subtropical climate** is a climate located on the west sides of continents between 30° and 45° latitude. It is the only humid climate with a strong winter precipitation maximum.

Mid-Latitude Climates

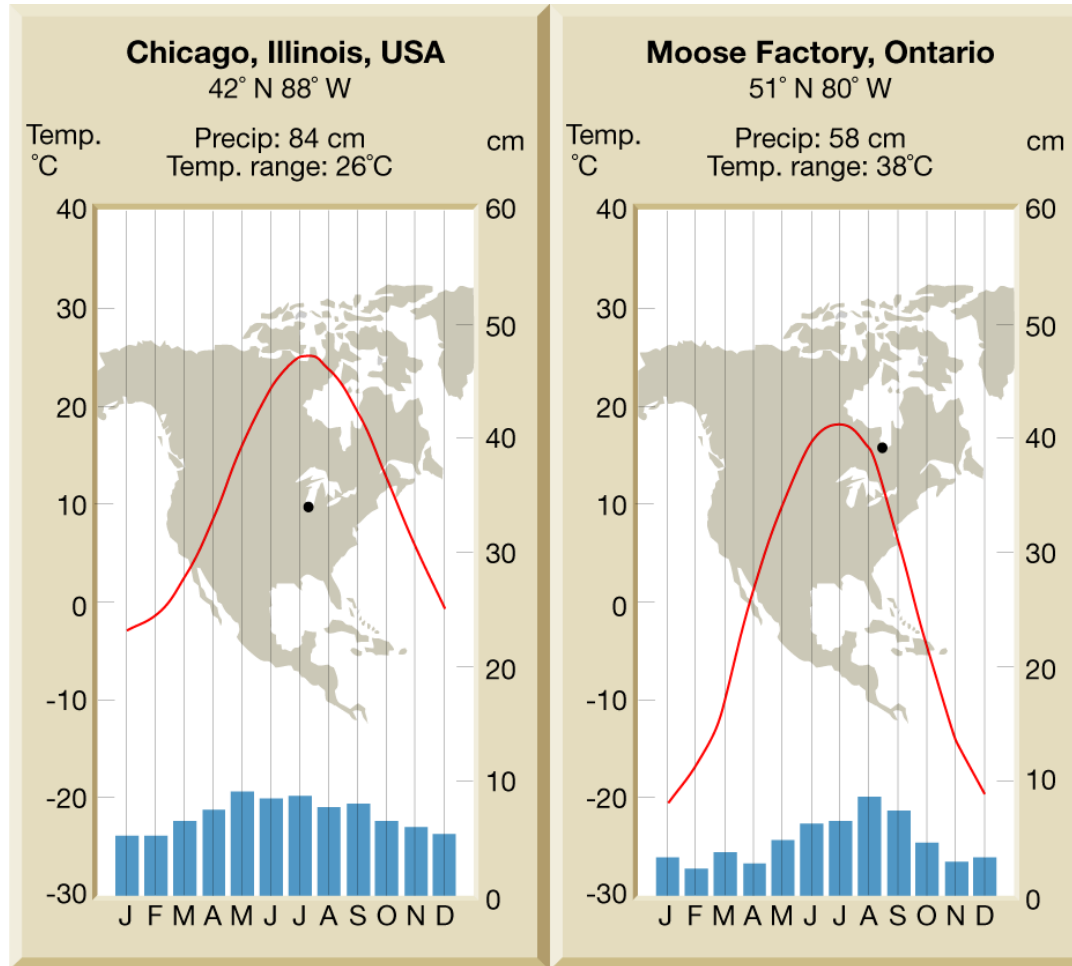


21.2 World Climates

Humid Mid-Latitude Climates

- ◆ Humid Mid-Latitude With Severe Winters
 - A **subarctic climate** is found north of the humid continental climate and south of the polar climate; it is characterized by bitterly cold winters and short, cool summers. Places within this climate realm experience the highest annual temperature ranges on Earth.

Mid-Latitude Climates



21.2 World Climates

Dry Climates

- ◆ A dry climate is one in which the yearly precipitation is not as great as the potential loss of water by evaporation.

21.2 World Climates

Polar Climates

- ◆ Polar climates are those in which the mean temperature of the warmest month is below 10°C .

An Ice Cap Climate Is a Polar Climate



21.2 World Climates

Highland Climates

- ◆ In general, highland climates are cooler and wetter than nearby areas at lower elevations.

21.3 Climate Changes

Natural Processes That Change Climates

◆ Volcanic Eruptions

- The presence of volcanic aerosols (ash, dust, and sulfur-based aerosols) in the air increases the amount of solar radiation that is reflected back into space. This causes Earth's lower atmosphere to cool.

◆ Ocean Circulation

- Changes in ocean circulation also can result in short-term climate fluctuations.

Eruption of Mount Pinatubo



Effect of El Niño



21.3 Climate Changes

Natural Processes That Change Climates

◆ Solar Activity

- When the sun is most active, it contains dark blemishes called sunspots. The formation of sunspots appears to correspond with warm periods in Europe and North America.

◆ Earth Motions

- Geographic changes in Earth's land and water bodies cause changes in climate.
- Changes in the shape of Earth's orbit and the tilt of Earth on its axis are other Earth motions that affect global climates.

21.3 Climate Changes

Human Impact on Climate Changes

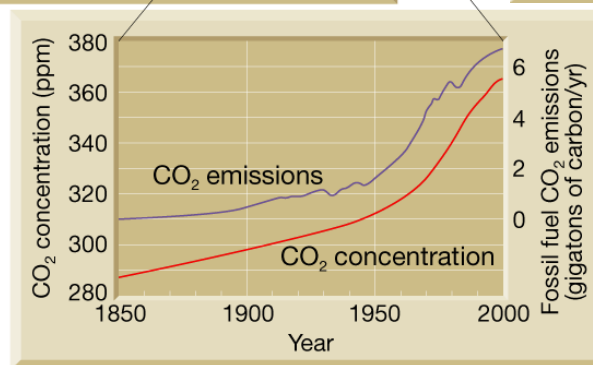
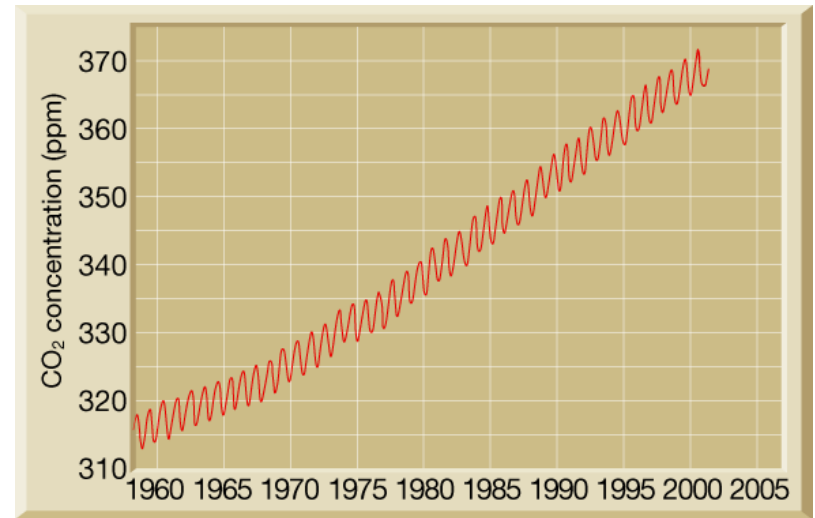
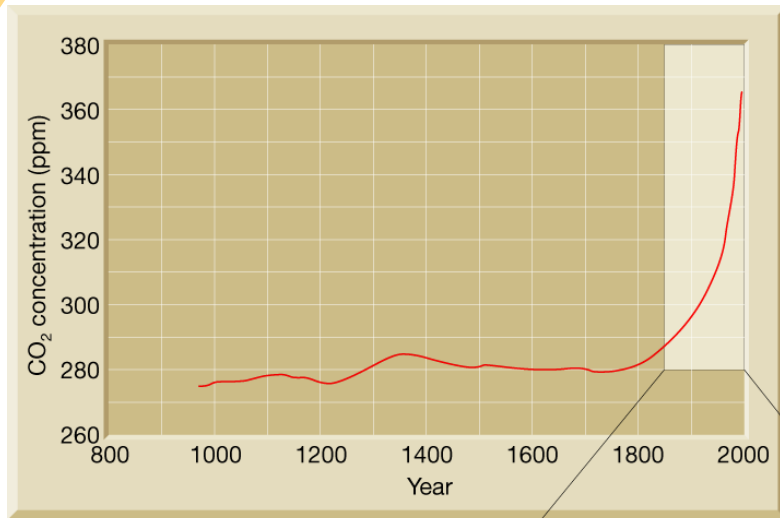
◆ The Greenhouse Effect

- The **greenhouse effect** is a natural warming of both Earth's lower atmosphere and Earth's surface from solar radiation being absorbed and emitted by the atmosphere.

◆ Global Warming

- As a result of increased levels of carbon dioxide and other greenhouse gases, global temperatures have increased. This increase is called **global warming**.

Carbon Dioxide Concentrations and Emissions



Increases in Greenhouse Gases and Changes in Temperature

